CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] In the rate of an isotactic pentad part, 0.85 to 0.99 and a melt index (A) 60 to polypropylene resin 97 mass [for 2-10g / 10 minutes] %, And the forming step to which the rate of (B) raceme pentad part [rrrr/(1-mmmm)] carries out melting extrusion of the resin constituent with which 0.15 to 0.50 and a melt index consist of polypropylene resin 40 of 2 - 10 10g / minutes - 3 mass % at the shape of a sheet, The production method of the transparent polypropylene sheet characterized by having the cooling process which carries out rapid cooling of the sheet-like object by which melting extrusion was carried out, and the heat treatment process which heat-treats the cooled sheet-like object by 70 degrees C or more and below the melting point of said polypropylene resin.

[Claim 2] It is the production method of the transparent polypropylene sheet characterized by cooling said sheet-like object by making the slit to which cooling water flows down said cooling process in the production method of a transparent polypropylene sheet according to claim 1 pass said sheet-like object.

[Claim 3] In the production method of a transparent polypropylene sheet according to claim 1 or 2, [said heat treatment process] The production method of the transparent polypropylene sheet characterized by carrying out from pinching and heating the front back of said sheet-like object with the metal endless belts and/or metal roll which have a specular surface.

[Claim 4] In the rate of an isotactic pentad part, 0.85 to 0.99 and a melt index (A) 60 to polypropylene resin 97 mass [for 2-10g / 10 minutes] %, And in the rate of (B) raceme pentad part [rrrr/(1-mmmm)], 0.15 to 0.50 and a melt index consist of polypropylene resin 40 of 2 - 10 10g / minutes - 3 mass %. When the **** elastic modulus of an extrusion molding direction (the direction of MD) sets 1700 or more MPa and sheet thickness to t [mm], all the Hayes H

[Mathematical formula 1]

$$H = 330t^2 - 150t + 20$$

The transparent polypropylene sheet characterized by being the following.
[Claim 5] The transparent polypropylene sheet characterized by the shock intensity at 5 degrees C being 2000 or more J/m in a transparent polypropylene sheet according to claim 4.
[Claim 6] It is the transparent polypropylene sheet characterized by said polypropylene resin (A) and (B) not containing a nucleating agent in a transparent polypropylene sheet according to claim 4 or 5.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the production method of a transparent polypropylene sheet, and a transparent polypropylene sheet.
[0002]
[Background of the Invention] Although the polyvinyl chloride resin currently used abundantly in the transparent sheet field has been used conventionally, the new transparent sheet which changes to polyvinyl chloride resin is demanded with the rise of the consciousness to an environmental problem in recent years etc. The sheet which consists of polypropylene is used as these sheets. However, a sheet which was superior not only to transparency but other physical properties, especially shock-proof one depending on the use is desired.
[0003] As the shock-proof improvement method of a transparent polypropylene sheet (1) The rapid cooling method using the HPP (gay polypropylene) resin constituent which blends the ethylene butene-1 copolymer of low crystallinity (JP,S62-227722,A), (2) in the ethylene propylene butene-1 copolymer of low density and the rapid cooling method using a nucleating additive combination HPP resin constituent, and this case The rapid cooling method using HPP which blended as PP the method (JP,H1-306448,A), (3) ethylene-propylene rubber, and the ethylene alpha olefin copolymer which blend RPP (random polypropylene) with HPP etc. is known.
[0004] Furthermore, as the improvement method of the rigidity of a transparent polypropylene sheet, and transparency, the method of blending transparent-ized agents, such as a nucleating agent and petroleum resin, with the materials of (4) polypropylene is known.
[0005]
[Problem to be solved by the invention] However, by the method of of (1), (2), and (3), although a shock-proof improvement is expectable, while being accompanied by the rigid fall of a sheet, transparency also falls victim. Furthermore, new problems, such as a fall of the transparency by generating of the gel at the time of recycling of a sheet, poor appearance, and printing aptitude and chlorosis at the time of bending processing, occur. Moreover, by the method of (4), a shock-proof fall poses a problem.

[0006] There is the purpose of this invention in offering the production method of a transparent polypropylene sheet and transparent polypropylene sheet which are equipped with shock resistance and rigidity and do not have the chlorosis at the time of bending processing as secondary elaboration, securing transparency.
[0007]
[Means for solving problem] [securing transparency from the resin constituent which consists of polypropylene resin which has specific composition that this invention persons should develop the transparent polypropylene sheet which has the above-mentioned desirable character, as a result of repeating examination wholeheartedly] It found out that the transparent polypropylene sheet which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration was obtained. This invention is completed based on this knowledge.
[0008] [namely, the production method of the transparent polypropylene sheet of this invention] In the rate of an isotactic pentad part, 0.85 to 0.99 and a melt index (A) 60 to polypropylene resin 97 mass [for 2-10g / 10 minutes] %, And the forming step to which the rate of (B) raceme pentad part [rrrr/(1-mmmm)] carries out melting extrusion of the resin constituent with which 0.15 to 0.50 and a melt index consist of polypropylene resin 40 of 2 - 10 10g / minutes - 3 mass % at the shape of a sheet, It is characterized by having the cooling process which carries out rapid cooling of the sheet-like object by which melting extrusion was carried out, and the heat treatment process which heat-treats the cooled sheet-like object by 70 degrees C or more and below the melting point of said polypropylene resin.
[0009] the ingredient ratio of polypropylene resin (A) -- 60 - 97 mass [of the whole resin constituent] % -- it is 70 - 95 mass % preferably. moreover, the ingredient ratio of polypropylene resin (B) -- 40 - 3 mass [of the whole resin constituent] % -- it is 30 - 5 mass % preferably.
[0010] A melt index (MI) is JIS. It can measure by the method based on K7210. the melt index of polypropylene resin (A) -- 2-10g/-- they are 2 - 10 5g / minutes preferably for 10 minutes. the melt index of polypropylene resin (B) -- 2-10g/-- they are 2 - 10 5g / minutes preferably for 10 minutes.
[0011] Here, the rate of an isotactic pentad part is isotactic **** in the pentad unit in the molecule chain of resin (that in which five propylene monomers carried out isotactic combination continuously). That is, the thing [comparatively / (PI value)] of mmmm is said in the rate of a pentad part measured using 13 C-NMR about the tacticity of gay polypropylene. This mmmm (00000) or (11111) an isotactic pentad is meant. m shows an isotactic yard and is 0 and 1. The configuration of each monomer unit in alignment with a polymer chain is shown, one configuration with 0 is expressed, and 1 expresses the opposite configuration.
[0012] The measuring method of this rate of an isotactic pentad part is announced by macro

MOREKYURUZU (Macromolecules)6925 (1973). the rate of an isotactic pentad part of polypropylene resin (A) -- 0.85 to 0.99 -- it is 0.87-0.96 preferably. When the rate of an isotactic pentad part is less than 0.85, an elastic modulus and other intensity fall. If 0.99 is exceeded, internal Hayes in a rapid cooling process will carry out under wrong, and the use as a transparent polypropylene sheet will become difficult.

[0013] As opposed to the main chain by carbon-carbon combination constituted here per five continuous propylene with arbitrary rrrr of the rate of a raceme pentad part [rrrr/(1-mmmm)] As opposed to the main chain by carbon-carbon combination which means the solid structure where five methyl groups which are side chains are located in a counter direction by turns, or its rate, and is constituted per five continuous propylene with arbitrary mmmm Each of five methyl groups which is side chains means the solid structure where it is located in this direction, or its rate.

[0014] the rate of a raceme pentad part of polypropylene resin (B) -- 0.15 to 0.50 -- it is 0.20-0.45 preferably. If shock intensity and transparency run short by less than 0.15, and the chlorosis at the time of bending processing also gets worse and this value exceeds 0.50, a **** elastic modulus will become inadequate. From the field of the balance of the characteristic of a transparent polypropylene sheet, the ranges of desirable rrrr/(1-mmmm) are 0.20-0.40.

[0015] In addition, this rrrr/(1-mmmm) is the value specifically measured as follows. Namely, JNM-FX-200 (the JEOL Co., Ltd. make, 13C-nuclear resonance frequency of 50.1MHz) is used. Measurement mode : The proton perfect decoupling method, pulse width:6.9microsecond (45 degrees), Pulse repetition time : 3s, number-of-times:of addition 10000 time, and solvent:1, 2, 4-bird chloro benzene / heavy benzene (90/10 volume %), The sample concentration of 250mg / 2.5ml solvent, measurement temperature : [perform 13 C-NMR measurement on 130-degree C conditions, and / with the difference in the chemical shift by the tacticity of a methyl group] That is, from the area intensity ratio of each peak of mmmm-mrrm which appears in a 22.5-19.5 ppm field, the rate of a pentad part was measured and the value of rrrr/(1-mmmm) was calculated.

mmmm: 21.86ppmmmmr:21.62ppmmmrr:21.08
ppmmmrm+rrmr:20.89ppmrrrr:20.36ppmmrrm : 19.97 ppm [0016] Other well-known OREFIN content copolymers for sheet forming below 4 mass % may be blended with the resin constituent of the above-mentioned composition, and the well-known additive agent for sheet forming, a spray for preventing static electricity, colorant, etc. may be added.

[0017] According to a forming step, a resin constituent is fabricated in the shape of a sheet. As the melting extrusion method of a forming step, T Di extrusion process is desirable. A sheet-like resin constituent has form once fixed by the cooling process. As the cooling method of a cooling process, the cooling method with water-cooling, air cooling, an endless belt, or a roll can be mentioned.

[0018] According to a heat treatment process, the surface of the resin constituent once solidified by the sheet-like object can be finished finely. In this heat treatment process, it can heat-treat using an endless belt, a roll, etc. Flatness, specular surface-ization, etc. can finish the resin constituent surface finely, maintaining sheet form, since the surface was fabricated before the resin constituent fused completely by heat-treating said resin constituent by 70 degrees C or more and below the melting point of said polypropylene resin. Here, if it is less than 70 degrees C, it is hard to soften a resin constituent and surface finish may become difficult. If higher than the melting point of said polypropylene resin, it may become difficult to perform a heat treatment process, a resin constituent's fusing completely and maintaining sheet form.

[0019] The transparent polypropylene sheet which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration is obtained securing transparency by carrying out fabrication, cooling, and heat treatment for the resin constituent of the above composition according to such this invention.

[0020] As for said cooling process, in the production method of the transparent polypropylene sheet of this invention, it is desirable to cool said sheet-like object by making the slit down which cooling water flows pass said sheet-like object.

[0021] [according to this / said cooling process] by making the slit down which cooling water flows pass said sheet-like object Since cooling water will water-cool directly while a sheet-like object passes a slit, the cooling solidification of the sheet-like object can be carried out without making the sheet form of a sheet-like object produce distortion etc.

[0022] It is the metal endless belts and/or metal roll with which said heat treatment process has a specular surface at the production method of the transparent polypropylene sheet of this invention, and it is more desirable than pinching and heating the front back of said sheet-like object to carry out.

[0023] According to this, said heat treatment process is the metal endless belts and/or metal roll which have a specular surface. From pinching and heating the front back of said sheet-like object, since the field which contacts a sheet-like object by carrying out is a specular surface, specular surface processing of the surface of a sheet-like object can be carried out.

[0024] In the rate of (A) isotactic pentad part, 0.85 to 0.99 and a melt index the transparent polypropylene sheet of this invention Polypropylene resin 60 of 2 - 10 10g / minutes - 97 mass %, And in the rate of (B) raceme pentad part [rrrr/(1-mmmm)], 0.15 to 0.50 and a melt index consist of polypropylene resin 40 of 2 - 10 10g / minutes - 3 mass %. When the **** elastic modulus of an extrusion molding direction (the direction of MD) sets 1700 or more MPa and sheet thickness to t [mm], all the Hayes H [0025]

[Mathematical formula 2]

$$H = 330t^2 - 150t + 20$$

[0026] It is characterized by being below the range of the above-mentioned formula.
[0027] Here, as thickness of a transparent polypropylene sheet, 150-1000 micrometers is 200-600 micrometers preferably.
[0028] Moreover, a **** elastic modulus is JIS. It can measure by the method based on K7113 etc. Here, the **** elastic modulus of an extrusion molding direction (the direction of MD) may not be practical in respect of intensity in their being less than 1700 MPa. All the Hayes H is JIS. It can measure by the method based on K7105 etc. All the Hayes H [0029]
[Mathematical formula 3]

$$H = 330t^2 - 150t + 20$$

[0030] If it is the following ranges of the above-mentioned formula, the transparent polypropylene sheet excellent in transparency can be obtained.
[0031] It becomes the transparent polypropylene sheet which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration, securing transparency by consisting of polypropylene resin of the above composition according to such this invention.
[0032] With the transparent polypropylene sheet of this invention, it is desirable that the shock intensity at 5 degrees C is 2000 or more J/m, and it is 2000 - 3000 J/m more preferably. Here, if shock intensity is less than 2000 J/m, it may fill neither a packaging material nor the shock intensity required of practical use of a clear file etc.
[0033] As for said polypropylene resin (A) and (B), with the transparent polypropylene sheet of this invention, it is desirable that a nucleating agent is not included.
[0034] According to this, since there is a nucleating effect which increases crystallization speed, a nucleating agent is re-heated, and when fabricating, it will crystallize, by the time it results in predetermined form, and it will fix form. On the other hand, since polypropylene resin (A) and (B) do not contain a nucleating agent, they do not degrade fabrication nature.
[0035]
[Mode for carrying out the invention] The form of operation of this invention is hereafter explained based on Drawings.
The [1st embodiment] The manufacture equipment 1 of the transparent polypropylene sheet concerning the 1st embodiment of this invention is shown in drawing 1 . The sheet forming means 11 which manufacture equipment 1 carries out melting kneading of the materials, and is pushed out in the shape of a sheet, It has the first cooling means 12 which carries out the cooling solidification of the sheet 20, a preheating means 13 to re-heat the cooled sheet 20, the heat treatment means 14 which heat-treats a sheet 20 and is used as a sheet 21, and the second cooling means 15 which cools the sheet 21 after heat treatment.
[0036] The sheet forming means 11 had the existing extrusion machines 111, such as a single axis extrusion machine or a multiaxial extrusion machine, and is equipped with Di [112] T for

sheet forming at the tip of an extrusion machine 111, for example. The sheet constituent by which melting kneading was carried out is pushed out from Di [112] T by these, and is fabricated in the shape of a field, and sheet forming is performed.

[0037] In the rate of (A) isotactic pentad part, 0.85 to 0.99 and a melt index this sheet constituent In addition, polypropylene resin 60 of 2 - 10 10g / minutes - 97 mass %, And the rate of (B) raceme pentad part [rrrr/(1-mmmm)] is the resin constituent with which 0.15 to 0.50 and a melt index consist of polypropylene resin 40 of 2 - 10 10g / minutes - 3 mass %.

[0038] Moreover, powder, granulation, the pellet type of the form of the materials used as a sheet constituent, etc. are arbitrary, and it is mixed so that a sheet constituent may serve as said ratio. In addition, a nucleating agent is not included, although other well-known OREFIN content copolymers for sheet forming below 4 mass % may be blended with the above-mentioned resin constituent and the well-known additive agent for sheet forming, a spray for preventing static electricity, colorant, etc. may be added.

[0039] The first roll 121 and second roll 122 which opposite arrangement of the first cooling means 12 is carried out within the large-sized tank 120 and the large-sized tank 120, and put a sheet 20, It is constituted from these rolls 121 and 122 by the third roll 123 installed in bottom slippage of the large-sized tank 120, the fourth roll 124 formed near the large-sized tank 120 periphery by the side of the preheating means 13, and the small tank 125 arranged at the large-sized tank 120 bottom.

[0040] The slit 126 is formed in Di's [112] T position and size corresponding to an opening as shown in the approximately center portion of the bottom of the small tank 125 at drawing 2 . Although perpendicularly formed to the bottom of the small tank 125, the form whose diameter is reduced is sufficient as it as this slit 126 goes to the slit 126 bottom.

[0041] The interval of a slit 126 is 3-10mm preferably 1-20mm in the entrance side of a slit 126. On the other hand, in the outlet side of a slit 126, it is thicker than a sheet 20 at least, and is 1.0mm or more preferably 0.5mm or more. In addition, a slit 126 is usually the thing of the shape of a wall with a thickness of 1-10mm and a length of about 30-70mm. Furthermore, the distance of a slit 126 and Di [112] T is usually about 30-250mm. In addition, although the figure was omitted, in the small tank 125, the cooling water for cooling a sheet 20 etc. can supply with a pump etc. continuously from the exterior.

[0042] The sheet 20 fabricated with the forming means 11 flows down through a slit 126 with the cooling water currently continuously supplied to the small tank 125, after that, with rotation of rolls 121, 122, and 123, it is introduced in the large-sized tank 120 by these, and cooling solidification is carried out.

[0043] the preheating means 13 -- abbreviation -- [roll / which were formed in parallel with the same height / the first and the third preheating roll 131 and 133] It is constituted by the second preheating roll 132 which shifted in the position across which it faces among the preheating

rolls 131 and 133 below a little, and was installed in it, and the pressure welding auxiliary roll 134 which pressure welding rolling of the peripheral surface is carried out, and puts a sheet 20 between the third preheating roll 133 from the upper and lower sides. In addition, an electrical heater etc. is built in, and the preheating rolls 131, 132, and 133 are heated so that a peripheral surface may serve as a desired temperature, respectively. Moreover, between the first preheating roll 131 and the fourth roll 124, you may install drainer equipment if needed. The sheet 20 by which cooling solidification was carried out is welded by pressure to the peripheral surface of the preheating rolls 131, 132, and 133 by these, and is preheated.

[0044] For a start, the heat treatment means 14 is torn off with the second and third heating roller 141, 142, and 143, the cooling roller 144, an endless belt 145, and the pressure welding auxiliary roll 146, and consists of rolls 147.

[0045] the first, the second heating roller 141 and 142, and the cooling roller 144 -- abbreviation -- it is prepared in parallel with the same height, and the third heating roller 143 is formed in parallel directly under the heating roller 142. [the peripheral surface of these firsts - the third heating roller 141, 142, and 143] By building in an electrical heater etc., respectively 70 degrees C or more, polypropylene resin (A), It is set below to the melting point (for example, about 175 degrees C) of (B), and is heated, on the other hand, the peripheral surface of the cooling roller 144 has structure through which cooling water etc. circulates, and it is cooled by desired temperature.

[0046] These circumferences are looped around the endless belt 145 as the first and the third heating roller 141 and 143, and the cooling roller 144 are arranged inside. Thereby, the endless belt 145 is stretched by the state where it was pushed into the inner side by the second heating roller 142 from the outside. In addition, an endless belt 145 is 0.4-1.5mm preferably that specular surface finish of the outside surface is carried out, and the thickness should just be within the limits of 0.1-3.0mm. Moreover, as for the quality of the material of an endless belt 145, it is desirable that it is SUS301, SUS304, SUS316, or the considerable quality of the material, and metal, such as carbon copper and titanium material, can also use it.

[0047] Pressure welding rolling of the pressure welding auxiliary roll 146 is carried out from the upper part of the first heating roller 141 at the peripheral surface. It tears off, and a sheet 20 is torn off from an endless belt 145, and a roll 147 opens a predetermined interval in about 144 cooling roller, and is formed in it. The sheet 20 preheated by these is welded by pressure to an endless belt 145 by rotation of the heating rollers 141, 142, and 143 and the cooling roller 144, and while being heated at a desired temperature, surface fabrication of it is carried out.

[0048] the second cooling means 15 -- abbreviation -- it is prepared in parallel with the same height, and consists of the second and third cooling roller 151, 152, and 153 and a pressure welding auxiliary roll 154 which pressure welding rolling is carried out and puts a sheet 20

between the third cooling roller 153 for a start which was alike, respectively and was cooled. However, as for the peripheral surface temperature of the cooling rollers 151, 152, and 153, it is more desirable than the cooling roller 144 that it is low temperature. The sheet 20 by which surface fabrication was carried out is contacted by the peripheral surface of the cooling rollers 151, 152, and 153, and it is cooled by these, moving.

[0049] Thus, in the form of this constituted operation, first, by the sheet forming means 11, a sheet constituent is pushed out in the shape of a field, is fabricated from Di [112] T, and a sheet 20 is fabricated (forming step).

[0050] Next, the cooling solidification of this sheet 20 is introduced and carried out to the first cooling means 12. [cooling water / namely, / with which the sheet 20 is continuously supplied to the small tank 125] It flows down through a slit 126 and is led into the large-sized tank 120 after that, and it is put between the first roll 121 and the second roll 122, is sent to the third roll 123, and is led out of the large-sized tank 120 with the fourth roll 124. While moving in the inside of this large-sized tank 120, the cooling solidification of the sheet 20 is carried out (the 1st cooling process).

[0051] Next, the sheet 20 by which cooling solidification was carried out is introduced to the preheating means 13, and is preheated by predetermined temperature. That is, a sheet 20 is led to the upper peripheral surface of the first preheating roll 131 from the fourth roll 124, is sent to the upper peripheral surface of the third preheating roll 133 through the peripheral surface of the lower part of the second preheating roll 132, is inserted with the pressure welding auxiliary roll 134, and is sent out. By moving in a zigzag direction up and down in this way, a sheet 20 is fully welded by pressure to the peripheral surface of the preheating rolls 131, 132, and 133, and is efficiently preheated uniformly to predetermined temperature (beforehand a heat process degree).

[0052] Next, the preheated sheet 20 is introduced to the heat treatment means 14, and the surface is fabricated smoothly. That is, a sheet 20 is led to the upper peripheral surface of the first heating roller 141 from the preheating roll 133, is inserted and welded by pressure with an endless belt 145 with the pressure welding auxiliary roll 146, and is stuck by the endless belt 145. A sheet 20 is led to the peripheral surface of the lower part of the second heating roller 142 with an endless belt 145, and is again welded by pressure to an endless belt 145 by the second heating roller 142.

[0053] Then, it is sent above the cooling roller 144 with an endless belt 145, and is cooled by the cooling roller 144, and a sheet 20 is torn off, is led to a roll 147, and exfoliates from an endless belt 145. The sheet 21 with which the sheet 20 was fully welded by pressure to the endless belt 145 by which specular surface processing was carried out in the state where it was heated below at the melting point of 70 degrees C or more and a resin constituent by these, and surface fabrication of the field welded by pressure was carried out smoothly is

obtained (heat treatment process).
[0054] Next, the sheet 21 which gave surface fabrication is introduced to the second cooling means 15, and is cooled to predetermined temperature. That is, a sheet 21 is torn off, is led to the upper peripheral surface of the first cooling roller 151 from a roll 147, is sent to the third cooling roller 153 through the peripheral surface of the lower part of the second cooling roller 152, and is welded by pressure with the pressure welding auxiliary roll 154. Thus, a sheet 21 is fully contacted and cooled by each cooling rollers 151, 152, and 153 (the 2nd cooling process). The transparent polypropylene sheet 21 of this operation is obtained by the above.
[0055] According to these above embodiments, there are the following effects.
(1) The transparent polypropylene sheet 21 which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration is obtained, securing transparency.
(2) since the surface can be fabricated before a resin constituent fuses completely by heat-treating the sheet 20 which is a resin constituent at a temperature within the limits below the melting point of 70 degrees C or more and a resin constituent Flatness, specular surface-ization, etc. can finish the resin constituent surface finely, with sheet form maintained.
[0056] (3) [the 1st cooling process] by passing the sheet 20 which is a sheet-like object about the slit 126 into which cooling water flows together with cooling water, and cooling a sheet 20 Since cooling water will water-cool directly while a sheet 20 passes a slit 126, the cooling solidification of the sheet 20 can be carried out without making the sheet form of a sheet 20 produce distortion etc.
(4) From the endless belt 145 which has a specular surface pinching and heating the front back of the sheet 20 which is a sheet-like object, since the field which contacts a sheet 20 by carrying out is a specular surface, the heat treatment process can carry out specular surface processing of the surface of the transparent polypropylene sheet 21.
(5) Since there is a nucleating effect which increases crystallization speed, a nucleating agent is re-heated, and when fabricating, it will crystallize, by the time it results in predetermined form, and it will fix form. On the other hand, since polypropylene resin (A) and (B) do not contain a nucleating agent, they do not degrade fabrication nature.
[0057] The [2nd embodiment] The 2nd embodiment of this invention is explained below. In addition, in the following explanation, the same thing as the portion and member which were already explained attaches the same mark, and carries out simple [of the explanation]. The manufacture equipment 2 of the transparent polypropylene sheet applied to the 2nd embodiment with reference to drawing 3 is explained. With the manufacture equipment 1 of the 1st embodiment, it had the small tank 125 which has the large-sized tank 120 and a slit 126 in the first cooling means 12 which carries out the cooling solidification of the sheet 20.
[0058] on the other hand, [the manufacture equipment 2 of the 2nd embodiment] The metal

endless belt 215 with which the first cooling means 22 was looped around between the 1st cooling roller 213 and the 2nd cooling roller 214, It differs in that have the 1st cooling roller 213, the 3rd cooling roller 216 which contacts, and the 4th roll 217 formed near the 2nd cooling roller 14, and it is constituted through the polypropylene resin sheet 11 and the metal endless belts 215.

[0059] In addition, as the chain line showed to drawing 1 , it is another cooling roller 215A in front of the 1st roll 213. It prepares and you may make it cool an endless belt 215 further by making it contact from the inner side of an endless belt 215.

[0060] As for the 1st cooling roller 213, the elastic material 218, such as fluoride rubber, is covered by the surface. That hardness (JIS K6301 A it is based on type) is [the thickness of this elastic material 218] a thing of 3mm or more 60 or less degrees. The metal endless belts 215 consist of stainless steel etc., and surface coarseness has a specular surface not more than 0.5S. At least as for one side of the 1st and the 2nd cooling roller 213 and 214, the axis of rotation 219 is connected with the rotation means (not shown).

[0061] Also in the 3rd cooling roller 216, surface coarseness has a specular surface below 0.5 S. And this cooling roller 216 contacts the 1st cooling roller 213 through a sheet 20 and the metal endless belts 215, and as it wins the sheet 20 moreover pressed with the endless belt 215 at this cooling roller 216 side, it is prepared. That is, as the sheet 20 in contact with the metal endless belt 215 and this endless belt 215 coils around a part of peripheral surface of the 3rd cooling roller 216, it moves in a zigzag direction.

[0062] The 4th roll 217 guides a sheet 20 so that a sheet 20 may be welded by pressure to the 2nd cooling roller 214 through an endless belt 215. Temperature adjustment devices (not shown), such as a water cooled system which enables surface temperature adjustment, are prepared in said each cooling rollers 213, 214, and 216.

[0063] Like the 1st embodiment, after performing a forming step using the sheet forming means 11, the cooling solidification of this sheet 20 is introduced and carried out to the first cooling means 22. Temperature control of each cooling roller 213,214,216 is carried out so that the skin temperature of the endless belt 215 and the 3rd cooling roller 216 which touch a sheet 20 and directly may be first kept concrete more than 50 degrees C or less and the dew point.

[0064] And the endless belt 215 which touches the 1st cooling roller 213 in the sheet 20 pushed out from Di [112] T of the extrusion machine, the 3rd cooling roller 216 -- abbreviation -- introducing between the 1st and the 3rd cooling roller 213 and 216, as it contacts simultaneously -- the 1st and the 3rd cooling roller 213 and 216 A sheet 20 is welded by pressure and it cools at 50 degrees C or less.

[0065] Under the present circumstances, the 1st and the 3rd cooling roller 213,216 By the thrust of a between, the elastic material 218 is compressed, and elastic deformation is made

and carried out. Both rolls 213 and 216 in which the elastic material 218 is carrying out elastic deformation Angle theta 1 from the center In the portion, the sheet 20 serves as field-like pressure welding with both the rolls 213 and 216. The planar pressure in this case is 0.1MPa - 20.0MPa.

[0066] Then, this sheet 20 is welded by pressure to the 3rd cooling roller 216 with the endless belt 215 of said specular surface, and it cools at 50 degrees C or less. [the sheet 20 pressed with the endless belt 215 at this cooling roller 216 side] angle theta 2 from the center of the cooling roller 216 being won over to the cooling roller 216 -- a sheet 20 -- this -- holding -- angle theta 2 In the portion, it is welded by pressure by an endless belt 215 and the 3rd cooling roller 216 in the shape of a field. The planar pressure in this case is 0.01MPa - 0.5MPa.

[0067] Next, it is made to move to the 2nd cooling roller 214 with rotation of an endless belt 215 in the state where the sheet 20 was made to meet so that it may overlap with an endless belt 215, this sheet 20 is welded by pressure to the 2nd cooling roller 214 through an endless belt 215, and it cools at 50 degrees C or less. The sheet 20 which was guided with the 4th roll 217 and pressed at this cooling roller 214 side is welded by pressure to the endless belt 215 in the shape of a field in angle theta3 portion from the center of the cooling roller 214. The planar pressure in this case is 0.01MPa - 0.5MPa (the 1st cooling process).

[0068] Then, as for a sheet 20, a transparent polypropylene sheet is obtained like the 1st embodiment through the preheating process by the preheating means 13, the heat treatment process by the heat treatment means 14, and the 2nd cooling process by the second cooling means 15.

[0069] According to these above embodiments, in addition to the effect (except for (3)) of the 1st above-mentioned embodiment, there are the following effects.

(6) The 1st and the 3rd roll 213 and 216 in which the elastic material 218 is carrying out elastic deformation Angle theta 1 It cools with field-like pressure welding of the sheet 20 with both the rolls 213 and 216 in a portion. It holds and is an angle theta 2. The metal endless belts 215, the field-like pressure welding of the sheet 20 by the 3rd cooling roller 216, cooling, and the angle theta 3 in a portion [with the endless belt 215, the field-like pressure welding of the sheet 20 by the 2nd cooling roller 214, and cooling in a portion] The sheet 20 of high transparency can be manufactured at high speed.

[0070] In addition, this invention is not limited to said each embodiment, and the modification in the range which can attain the purpose of this invention, and improvement are included in this invention. For example, although the endless belt 145 was used by said each embodiment as a heat treatment process, it is not restricted to this, but it is a metal roll etc. and a heat treatment process may be carried out. In addition, concrete structure, form, etc. at the time of carrying out this invention are good also as other structures etc. within limits which can attain the purpose of this invention.

[0071]
[Working example] Hereafter, a work example and a comparative example are given and this invention is explained more concretely. In addition, this invention is not limited to the contents of a work example. The transparent polypropylene sheet 21 was manufactured for concrete conditions on condition of the following descriptions and Table 1 using the manufacture equipment 1 (refer to drawing 1) of the 1st embodiment.
[0072] Polypropylene resin (A)
HPP-1 (gay polypropylene): It is rate 0.90:MI by an isotactic pentad. 3.0g / 10 minute HPP-2 (gay polypropylene): It is rate 0.92:MI by an isotactic pentad. 2.0g / 10 minutes [0073] Polypropylene resin (B)
TPO(Thermo Plastic Olefin elastmer)
: Rate of a raceme pentad part [rrrr/(1-mmmm)] 0.24 : The rate of an isotactic pentad part 0.76 : MI 2.8g / 10 minutes : Melting point [measurement by the DSC method] 158.7 degrees C : Dissolution ENTA rupee [deltaH] 81 J/g [0074] = The above-mentioned rate of an isotactic pentad part and the above-mentioned rate of a raceme pentad part [rrrr/(1-mmmm)] are the value specifically measured as follows. Namely, JNM-FX-200 (the JEOL Co., Ltd. make, 13C-nuclear resonance frequency of 50.1MHz) is used. Measurement mode : The proton perfect decoupling method, pulse width:6.9microsecond (45 degrees), Pulse repetition time : 3s, number-of-times:of addition 10000 time, and solvent:1, 2, 4-bird chloro benzene / heavy benzene (90/10 volume %), The sample concentration of 250mg / 2.5ml solvent, measurement temperature : [perform 13 C-NMR measurement on 130-degree C conditions, and / with the difference in the chemical shift by the tacticity of a methyl group] That is, from the area intensity ratio of each peak of mmmm-mrrm which appears in a 22.5-19.5 ppm field, the rate of a pentad part was measured and the value of rrrr/(1-mmmm) was calculated.
mmmm: 21.86ppmmmmr:21.62ppmmmrr:21.08
ppmmmrm+rrmr:20.89ppmrrrr:20.36ppmmrrm : 19.97 ppm [0075]
Random polypropylene RPP : Ethylene content 3wt% : MI 5.0g / 10 minutes [0076]
Straight chain-like low-density-polyethylene LLDPE : Density 907kg/m3 : MI 3.0g / 10 minutes [0077] The temperature of a resin constituent : temperature [near 240 degree-CT Di's 112 opening]: -- 280 degrees C -- beforehand -- a heat process -- part [for circumference speed:15-25m/of the temperature:145-degree-C endless belt 145 of the heating rollers 141, 142, and 143 of the temperature:110 degree-C surface forming step of the preheating rolls 131, 132, and 133 of a like] [0078] =
[Table 1]

		実施例1	実施例2	実施例3	比較例1	比較例2
原料構成		HPP-1(85wt%) TPO(10wt%) HPP-2(5wt%)	HPP-1(87wt%) TPO(8wt%) HPP-2(5wt%)	HPP-1(90wt%) TPO(5wt%) HPP-2(5wt%)	HPP-1(85wt%) RPP(10wt%) HPP-2(5wt%)	HPP-1(85wt%) LLDPE(10wt%) HPP-2(5wt%)
	厚み(μm)	300	300	300	300	300
引張特性	弾性率(MPa) MD/TD	2100/2100	2100/2100	2100/2200	2100/2200	2000/1900
光学特性	ヘイズ(%) 全/内部	3.5/1.5	3.6/1.6	3.8/1.8	4.0/2.2	3.8/2.5
	光沢度(%)	140	138	138	136	138
衝撃強度 (J/m)	23℃	NB	NB	NB	4840	NB
	5℃	2200	2100	2100	2000	2500
	-5℃	1700	1670	1650	1560	1950
	折曲白化	◎	◎	◎	○	△

[0079] Here, each characteristic of the done transparent polypropylene sheet 21 was evaluated. An evaluation result is shown in Table 1. A **** elastic modulus is JIS. It measured by the method based on K7113. In addition, the thing of the perpendicular direction of the direction of MD (the direction of forming extrusion) is said in TD.

[0080] All the Hayes and internal Hayes are JIS. Based on K7105, it measured using the Hayes measurement machine (made by Nippon Denshoku Industries). A degree of brilliancy is JIS. Based on K7105, it measured using the automatic type colorimetric color difference meter (made by Suga Test Instruments Co., Ltd.). Moreover, a film impact tester (Oriental Energy Machine factory) is used for shock intensity, and it is test force. It is the conditions of 30kg and a 1-inch head, and measured at 23 degrees C and 5 degrees C-5 degrees C. In addition, NB in Table 1 is measurement full-limits 10000 J/m, and shows that material destruction did not occur at the time of measurement.

[0081] Moreover, it bent at the time of bending the done transparent polypropylene sheet 21, and white voltinism was also evaluated.

O : don't carry out chlorosis.

O : -- chlorosis -- it can check slightly with slightness and a naked eye.

**: It can check with the naked eye which carries out chlorosis.

[0082] As shown also in Table 1, it compares with the comparative examples 1 and 2 which do not contain polypropylene resin (B) but contain RPP and LLDPE. It turns out that it is the transparent polypropylene sheet which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration the work examples 1-3 containing polypropylene resin (B) securing transparency.

[0083]

[Effect of the Invention] According to this invention, the transparent polypropylene sheet which is equipped with shock resistance and rigidity and does not have the chlorosis at the time of bending processing as secondary elaboration can be obtained, securing transparency.

[Translation done.]